

RISK-BASED PRIORITY MODEL

The ES&H scoring and ranking process involves the assessment of various risks related to environmental or safety and health activities. Because risk consists of the product of impact severity (consequence) and likelihood, the process requires consideration and evaluation of all these factors in deriving a risk value. The ES&H Risk-based Priority Model (RPM), shown in Table 1, provides the framework for deriving activity priorities. This document describes the elements of the RPM and provides explanations and examples of use and interpretation of the model in the ranking process. The document is divided into the following sections:

1. Descriptions of each RPM matrix impact level (1 through 18) with examples to illustrate situations to which different impacts apply.
2. Descriptions of each RPM matrix likelihood level (A through D).
3. Methodology for revising either RPM impacts or likelihoods to accommodate facility data.

TABLE 1
ES&H RISK-BASED PRIORITY MODEL (RPM)

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IMPACTS	LIKELIHOOD OF OCCURRENCE			
	A	B	C	D
	VERY HIGH	HIGH	MEDIUM	LOW
CATEGORY: PUBLIC SAFETY AND HEALTH				
1. Immediate or eventual loss of life/permanent disability	3000	300	30	0.3
2. Excessive exposure and/or injury	300	30	3	0.03
3. Moderate to low-level exposure	30	3	0.3	0.003
CATEGORY: SITE PERSONNEL SAFETY AND HEALTH				
4. Catastrophic - Injuries/illnesses involving permanent total disability, chronic or irreversible illnesses, extreme overexposure, or death	2000	200	20	0.2
5. Critical - Injuries/illnesses resulting in permanent partial disability or temporary total disability > 3 months, or serious overexposure	200	20	2	0.02
6. Marginal - Injuries/illnesses resulting in hospitalization, temporary, reversible illnesses with a variable but limited period of disability of < 3 months, slight overexposure (e.g., 5-10 rem), or exposure near limits	100	10	1	0.01
7. Negligible - Injuries/illnesses not resulting in hospitalization, temporary reversible illnesses requiring minor supportive treatment, or exposures below 20% of limits	10	1	0.1	0.001
CATEGORY: COMPLIANCE				
8. Major noncompliance with Federal, State, or Local Laws; Enforcement Actions; or Compliance Agreements significant to ES&H and involving significant potential fines or penalties	150	15	1.5	0.015
9. Major noncompliance with Executive Orders; DOE Orders; Necessary and Sufficient Standards; or Secretary of Energy Directives (Notices or Guidance Memoranda) significant to ES&H but not involving significant potential fines and penalties	75	7.5	0.75	0.0075
10. Marginal noncompliance with Federal, State, Local Laws; Enforcement Actions; Compliance Agreements; Executive Orders; DOE Orders; Necessary and Sufficient Standards; or Secretary of Energy Directives significant to ES&H	20	2	0.2	0.002
11. Significant deviation from good management practices	1	0.1	0.01	0.0001

**TABLE 1 (cont'd.)
ES&H RISK-BASED PRIORITY MODEL (RPM)**

Sheet 2 of 2

IMPACTS		LIKELIHOOD OF OCCURRENCE			
		A	B	C	D
		VERY HIGH	HIGH	MEDIUM	LOW
CATEGORY: MISSION IMPACT					
12.	Serious negative impact on ability to accomplish major program mission	150	15	1.5	0.015
13.	Moderate negative impact on ability to accomplish major program mission	75	7.5	0.75	0.0075
CATEGORY: COST-EFFECTIVE RISK MANAGEMENT					
14.	Significant avoidable costs due to degrading infrastructure, inefficient management systems or program implementation, or accident-related capital loss (annual costs > \$5M, or one-time costs > \$25M)	40	4	0.4	0.004
15.	Moderate avoidable costs due to degrading infrastructure, inefficient management systems or program implementation, or accident-related capital loss (annual cost \$1M-5M/year, or one-time costs < \$25M)	15	1.5	0.15	0.0015
CATEGORY: ENVIRONMENTAL PROTECTION					
16.	Catastrophic damage to the environment (widespread and long-term or irreversible effects)	2000	200	20	0.2
17.	Significant damage to the environment (widespread and short-term effects, or localized and long-term or irreversible effects)	200	20	2	0.02
18.	Minor to moderate damage to the environment (localized and short-term effects)	20	2	0.2	0.002

Section 1 RPM Matrix Impacts

The rows of the RPM matrix constitute the impacts used to score the risk benefits of activities. The matrix impacts are organized in six categories, representing the major types of risks important to ES&H activities:

1. Public Safety and Health includes potential adverse impacts on the health and safety of the *off-site* population surrounding a facility.
2. Site Personnel Safety and Health includes potential adverse impacts on the safety and health of individuals *inside the facility boundary*. This includes site workers and visitors.
3. Compliance includes failures to comply with laws, regulations, compliance agreements, Executive Orders, necessary and sufficient standards, and DOE Orders related to Environment, Safety and Health. Such failures may adversely affect the confidence of DOE or other agencies in the ability of the facility to operate while protecting the public, workers, and the environment.
4. Mission Impact includes potential adverse impacts on the ability to perform the research or production mission of the facility or the ability to carry out important parts of the mission.
5. Cost-Effective Risk Management includes potential accidental losses to a facility's capital investment (buildings, equipment) or an existing opportunity for cost savings, such as infrastructure upgrades, management systems upgrades, or improved program development.
6. Environmental Protection includes potential adverse harmful impact on natural resources (air, water, land, wildlife).

Each of the six categories includes two or more impacts representing different levels of severity within the category. For example the Site Personnel Safety category includes four impacts of decreasing severity: catastrophic, critical, marginal, and negligible. The following sections define the RPM impacts.

1.1 Public Safety and Health

Impact 1 Immediate or eventual loss of life/permanent disability

This impact should be chosen when a potential result of a condition being

evaluated could lead to permanent disability (loss of limb, sight, hearing.) or loss of life by one or more members of the off-site population. This impact includes immediate deaths and disabling injuries, as well as future cancer deaths or genetic damage and effects that might result from releases of hazardous or radioactive materials that breach the site boundaries. Such releases could be the result of accidents that release hazardous materials within a building combined with failures in building confinement or containment, accidents during off-site transportation, or catastrophic events resulting in direct release of materials (e.g., fire, explosion).

Example

A facility has proposed a set of seismic safety improvement projects to correct structural and equipment deficiencies that could contribute to building failures in case of an earthquake. Under current conditions, there is a high likelihood of building structural failure in a strong earthquake. Structural failure may result in a chemical release or fire that could spread off-site. Because a number of public facilities and private residences are in close proximity to the site boundary, public safety could be threatened and fatalities are possible.

Impact 2 Excessive exposure and/or injury

This impact indicates the potential for excessive exposure or injury to the off-site population, but without the potential for death or permanent disabling injury (*i.e.*, recovery from potential injuries is expected). Excessive exposures to radioactive or hazardous materials are those that exceed published acceptable limits.

Example

The example given for Impact 1, above, could apply to this impact if the volume of chemicals that could potentially be released was reduced such that death or permanent injury was not expected. However, public exposures to hazardous substances that exceed limits would still be expected.

Impact 3 Moderate- to low-level exposure

This impact indicates the potential for exposure of the off-site population

to hazardous or radioactive materials, but these exposures are no greater than published acceptable limits. Immediate deaths or injuries are not expected. Rates of cancer incidence in the population would not detectably increase.

Example

A facility must purchase modern radiation survey equipment to comply with DOE Orders 5400.5 and 5480.11 and ANSI N323. Existing survey equipment does not meet requirements for lower limits of detection for release of equipment or materials from radioactive materials management areas at the facility. Because of this inadequacy in detection instrumentation, there is a chance that contaminated materials may be inadvertently released to uncontrolled areas and subsequently travel off-site. Because of the nature and volume of the potential released contaminated materials, however, the potential releases would not constitute a threat to public health, but could result in a minimal exposure of members of the public to radioactive material.

Impacts 1, 2, and 3 differ in the extent of potential off-site consequences. In considering the potential consequences of a condition at a facility, the following factors should be considered:

1. The nature of possible accidents that could occur at the facility;
2. The potential for off-site release of hazardous or radioactive material in case of an accident;
3. The amount and type of hazardous or radioactive material present; and
4. The potential for deaths, injuries, or exposures of the off-site population.

Impacts 1, 2, and 3 do not include deaths or disabling injuries that may be experienced by site visitors. Impacts on visitors are treated as equivalent to effects on site workers, as visitors to the site are considered to have accepted on-site risks when they entered the site boundary.

1.2 Site Personnel Safety and Health

Impact 4 Catastrophic: Injuries/illnesses involving permanent total disability, chronic or irreversible illnesses, extreme overexposure, or death

This impact encompasses potential permanent effects among the site worker population. Such effects may result from industrial accidents or excessive exposures to hazardous or radioactive materials. This impact includes immediate deaths and disabling injuries as well as future deaths from latent effects such as cancer.

Example

A facility has proposed a Line Item Project to bring site buildings into compliance with fire and life safety codes and to correct deficiencies found in a facility-wide fire protection engineering survey. Deficiencies include inadequate sprinklers, fire barriers, alarms, exit corridors, and exit doors. In case of fire in a site building with these deficiencies, fire and smoke can spread quickly through the building. Fire alarms cannot be heard in some parts of the buildings and some exit corridors are too long, poorly protected, or poorly marked. Under these conditions, a fire may lead to a fatality of a site worker in the affected building.

Example

A facility has proposed a set of seismic safety improvement projects to correct structural and equipment deficiencies that could contribute to building failures in case of an earthquake. Under current conditions, there is a high likelihood of building structural failure in a strong earthquake. Persons inside the deficient buildings would be at risk and fatalities are possible.

Impact 5 *Critical: Injuries/illnesses resulting in permanent partial disability, temporary total disability (> 3 months), or serious overexposure*

This impact involves injuries, illnesses, or exposures that result in lengthy hospitalization and significant recuperation time, but are not expected to result in death or permanent total disability. This impact includes exposures to radioactive or hazardous materials that may exceed published acceptable limits.

Impact 6 *Marginal: Injuries/illnesses resulting in hospitalization, temporary reversible illnesses with a variable but limited period of disability (<3 months), slight overexposure, or exposure near limits (20-100%)*

This impact involves worker injuries, illnesses, or exposures that result in emergency room treatment, limited hospitalization, and lost work time. Time required for recuperation from these effects, however, is not extensive.

Example

A facility proposes a Line Item Project to improve pedestrian and vehicular safety through roadway modifications. This project will improve sight lines at turns and intersections and widen narrow portions of site roadways. Under current conditions, the facility experiences about two road accidents per year. These accidents are typically minor, but do occasionally result in injuries requiring limited hospitalization.

Impact 7 Negligible: Injuries/illnesses not resulting in hospitalization, temporary reversible illnesses requiring minor supportive treatment, or exposures below 20% of limits

This impact involves worker injuries, illnesses, and exposures that would be expected to result in no lost work time (unless the exposure resulted in a cumulative dose exceeding limits). Standard first aid is expected to be adequate treatment.

1.3 Compliance

Impact 8 Major noncompliance with Federal, state, or local laws; enforcement activities; or compliance agreements significant to environment, safety, or health and involving significant potential fines or penalties

This impact includes major violations of laws, regulations, codes, enforcement actions, compliance agreements, or standards. These non-compliances have the following characteristics.

1. Violation of the law, regulation, code, enforcement action, compliance agreement, or standard could result in the imposition of fines on DOE or the operating organization, imprisonment of DOE or operating organization personnel, liability for the payment of significant damages, or other legal penalties.
2. The existing situation must represent a *major, substantive non-*

compliance with the law, regulation, code, or standard. If existing conditions are substantially in compliance with only minor exceptions, then this impact does not pertain (see definition of Impact 10 below).

3. The violated law, regulation, code, or standard must be significant to environment, safety, or health.

If an activity addresses a major non-compliance with an environmental law or regulation (such as the CAA, RCRA, or CERCLA), the compliance impact should be 8. If an activity addresses a major non-compliance with a rule subject to penalties under the Price-Anderson amendments act, then impact 8 also applies.

In general, non-compliance with a DOE Order or necessary and sufficient standard should be scored using Impact 9 or 10 below because fines or criminal penalties do not typically result from DOE Order non-compliance. Likewise, non-compliance with an OSHA requirement or a DOE OSH Order should be scored using Impact 9 or 10 below, unless OSHA has the force of law at a facility (which is not currently the case at most DOE facilities). If an activity addresses a major non-compliance with an environmental law and a DOE Order simultaneously, the applicable compliance impact with the highest potential risk reduction score should be chosen (in this case Impact 8).

Example

A facility has proposed a project to expand its hazardous waste storage and disposal capability. Currently, hazardous waste handling capability is inadequate, so that waste remains in temporary storage locations for longer than 90 days. This is a violation of RCRA and the facility may be fined by the EPA. Because this example involves non-compliance with an environmental law, it would be scored with Compliance Impact 8.

Example

A contractor radiation protection program requires several changes in order to comply with 10CFR-835 provisions. A large number of further changes are required in order to implement the DOE Radiological Control Manual. Impact 8 applies to those activities needed to achieve 10CFR-835 compliance, because non-compliance is subject to legal action under Price-Anderson. Impact 8 does not apply, however, to additional activities (beyond 10CFR-835 provisions) needed to implement the Rad Con

manual.

The RPM compliance impacts that apply to Rad Con manual implementation depend on whether the activities needed for implementation have some other compliance driver. If the activities have a compliance driver, such as a DOE Order, then impacts 9 or 10 apply (see impact descriptions below). Otherwise, if the activities are best management practices or recommendations without a formal compliance driver, then impact 11 applies.

Impact 9 *Major noncompliance with Executive Orders; DOE Orders; necessary and sufficient standards; or Secretary of Energy Directives (Notices or Guidance Memoranda) that are significant to environment, safety, or health but not involving significant potential fines and penalties.*

This impact includes significant non-compliances with any DOE Order, necessary and sufficient standard, or Secretary of Energy Directive that is significant to ES&H. To distinguish Impact 9 from Impact 8, non-compliances included under Impact 9 cannot result in fines, imprisonment, or other legal penalties. Impact 9 also includes facility non-compliance with laws, regulations, codes, and standards (e.g., OSHA, NFPA, ANSI, NEC, MSHA) that are referenced in DOE Orders, but do not have the force of law at the facility¹. As with non-compliance covered under Impact 8 above, conditions of non-compliance included in this impact must be *major, substantive* non-compliances and must relate to requirements that are significant to environment, safety, and health. The impact does not include marginal non-compliances, such as minor administrative discrepancies (see definition of Impact 10 below).

Example

A recent audit finding identified that the Hazards Communication Program at a Facility is not in compliance with the requirements of DOE Order 5480.10. All aspects of the program are lacking, including surveillance, communications, and record-keeping. A facility proposes to add 5 FTEs to upgrade the Hazards Communication Program.

Example

¹OSHA may have the force of law at a minority of facilities. At these facilities, significant non-compliances with OSHA would be included under Impact 8.

A facility proposes to increase staff in its industrial safety section to support efforts for achieving full compliance with DOE-required OSHA standards (such as DOE Order 5483.01). Without this additional staffing, the facility will remain substantively out of compliance.

Example

A facility has proposed a GPP project to upgrade electrical cable that does not comply with NEC requirements. Compliance with NEC requirements is needed for conformance with DOE Order 6430.1A.

Impact 10 *Marginal noncompliance with Federal, state, and local laws; enforcement actions; compliance agreements; Executive Orders; DOE Orders; necessary and sufficient standard; or Secretary of Energy Directives that are significant to ES&H*

This impact includes *minor* discrepancies in compliance with laws, regulations, codes, standards, Orders, or directives that are significant to ES&H (the same group of laws and orders, that are included in Impacts 8 and 9). It is differentiated from Impacts 8 and 9, which cover major non-compliance conditions. This impact pertains to conditions in which current ES&H programs largely conform to the requirements of applicable laws and Orders., but do not fulfill certain marginal or administrative aspects of the requirements.

For example, if a facility has fulfilled the actual substantive physical requirements of a law or Order, but has not completed all administrative requirements or paper work, then Impact 10 applies.

Example

A facility proposes to add 1 additional clerical employee to assist the IS Manager in support of the Hazards Communication Program which was recently upgraded as required by DOE Order 5480.10. The responsibilities of this new employee will be record keeping and clerical support for visiting assessment teams. Recent audits have indicated that the program is adequate, but to be in full compliance the Facility must keep better records of communication activities and provide better clerical support for visiting assessment teams to allow them to obtain a more comprehensive picture of the state of the Facility's compliance.

Example

DOE Order 5480.07 requires that facilities have adequate fire protection systems in buildings, that these systems be tested and inspected routinely, and that the facility maintain records of the fire system testing and surveillance. If a facility has adequate fire protection systems in each building and has routinely performed the required testing and surveillance on these systems, but has failed to keep timely records of the testing and surveillance, then the appropriate impact in this case would be Impact 10.

Impact 11 Significant deviation from good management practices

This impact indicates a significant deviation from accepted industry or DOE standards for the performance of activities in a given area. Such directives or good practices do not have the weight of a law or DOE Order, nor do they have the importance of a directive or instruction issued by the Secretary of Energy.

1.4 Mission Impact

Impact 12 Serious negative impact on ability to accomplish major program mission

This impact includes conditions that seriously curtail or prevent accomplishment of the mission of a major program at a site. The condition need not shut down the entire site, but must threaten the continuation of at least one of the facility's major research or production missions. Under this impact, the interruption of the affected program mission must be of sufficient duration to pose serious doubts about the feasibility of accomplishing yearly goals or objectives set for the program.

The program mission impact may be due to regulatory or administrative shutdown of part of a facility, a catastrophic accident preventing continued activities, or the unavailability of equipment, staff, or other resources required by the program.

Example

A facility has proposed a Line Item Project to bring site buildings into compliance with fire and life safety codes, and to correct deficiencies found in a facility-wide fire protection engineering survey. Deficiencies include inadequate sprinklers, fire barriers, alarms, exit corridors, and exit doors. In case of fire in a site building with these deficiencies, fire and

smoke can spread quickly through the building and significant portions of the building may be damaged or destroyed. If so, research programs under way in this building will be severely disrupted and unable to continue before the replacement of necessary facilities. This disruption will impede progress in the research and may make it impossible to achieve goals set for the program.

Example

Radiological surveys of chemistry laboratories at a site have discovered previously unknown contamination outside of posted radiological areas. In order to fully comply with DOE Order 5480.11 and DOE ALARA guidelines, the facility is proposing to fund systematic, detailed surveys of the laboratories and management of any contamination that is discovered. If this work is not performed, then all chemistry division laboratories could be zoned as radiation areas. This would result in loss of effective use of the laboratory facilities and prevent progress in major programs that rely on the facilities.

Impact 13 Moderate negative impact on ability to accomplish major program mission

This impact includes conditions preventing accomplishment of major program missions at a site. However, the interruptions of programs considered under this impact are shorter than those included under Impact 12 above. The interruptions included under Impact 13 may pose risks to the achievement of set program goals or objectives, but still allow the possibility that such goals or objectives may be met.

Example

A facility must institute a site roadway safety and stabilization program to meet Federal and State safety standards. This project will stabilize landslides adjacent to roads at the site. Without this work, the landslides threaten to displace roadways and underground utilities. If this occurred, access and utility supplies to some site buildings could be disrupted, interrupting programs in these locations. However, repairs to re-establish access and utilities are not expected to cause an excessive disruption of progress on these programs, however.

1.5 Cost-Effective Risk Management

Impact 14 Significant avoidable cost such as degraded infrastructure, inefficient management systems or program implementation, or accident-related capital loss (total cost > \$25M or annual cost > \$5M)

Impacts 14 and 15 involve either the loss of DOE capital investment due to accidents or an existing opportunity for cost savings (such as infrastructure upgrades, management systems upgrades, or improved program development). The difference between Impacts 14 and 15 is the dollar value shown to be at risk or the dollar value of the cost savings opportunity.

For Impact 14, the loss of investment could include loss of buildings, equipment, materials, finished products, or supplies, in which DOE had invested greater than \$25 million. Such loss could be incurred by events such as fire, explosion, human errors, or natural occurrences.

In addition to situations involving financial loss due to accidents, Impact 14 also includes opportunities for cost savings that would have a positive financial impact. Prominent among such opportunities are situations in which an immediate preventive investment can help avoid a potentially greater cost impact in the future. Examples include neglected facility infrastructure for which short-term expenditures on physical upgrades or increased maintenance or surveillance can help avoid increased long-term costs due to continued neglect or degradation or potential catastrophic damage. For Impact 14 to apply, the total cost savings must exceed \$25 million.

Impact 14 also includes annual cost impacts greater than \$5 million incurred as a result of a condition causing losses to a facility's capital stock. Similarly, Impact 14 includes opportunities for recurring annual preventive or other positive financial impacts exceeding \$5 million. Examples include opportunities to develop improved ES&H management systems that increase the efficiency of managing ES&H issues, thereby promoting the early identification of problems, the setting of appropriate priorities for addressing issues, and definition of cost-effective activities for addressing issues.

Example

A facility has proposed a Line Item Project to bring site buildings into compliance with fire and life safety codes and to correct deficiencies found in a facility-wide fire protection engineering survey. Deficiencies include inadequate sprinklers, fire barriers, alarms, exit corridors, and exit doors.

In case of fire in a site building with these deficiencies, fire and smoke can spread quickly through the building and significant portions of the building may be damaged or destroyed. If so, the cost of repair or replacement of the building and its contents could exceed \$25M.

Example

A site contractor has proposed launching a behavior-based safety process to improve worker safety and decrease the frequency of on-the-job injuries. The process includes workplace observation and feedback to workers to improve the safety of workplace behaviors. In addition to substantial expected safety improvements, the process is expected to yield substantial annual cost savings through reduction of workman's compensation expenses. The avoided costs could exceed \$5M per year.

Example

A national laboratory has identified several site buildings that have not been maintained adequately for many years and are in need of immediate physical upgrades and/or enhanced maintenance and surveillance. Without short-term commitment of resources, these buildings are subject to continued deterioration and potential catastrophic damage that would require large expenditures to remediate. The remediation costs could top \$25M if such damage occurs.

Impact 15 Moderate avoidable cost due to degraded infrastructure, inefficient management systems or program implementation, or accident-related capital loss (total cost <\$25M or annual cost \$1M-5M).

This impact is similar to Impact 14, with the exception of the dollar amounts of the loss of investment. This impact includes lower investment losses or cost savings opportunities.

Example

A facility proposes a Line Item Project for a site roadway safety and stabilization program to meet Federal and State safety standards. This project will stabilize landslides adjacent to roads at the site. Without this work, the landslides threaten to displace roadways and underground utilities. The damaged roadways and utilities would have to be repaired or replaced, but the cost of such work would be lower than \$25M.

Example

A national laboratory and DOE Operations Office ES&H division propose coordinated development of an integrated issue management and commitment tracking system to improve the efficiency of ES&H management at the lab, increase accountability, and allow the Operations Office to perform its oversight role more productively. It is expected that implementation of such a system will improve the cost-effectiveness of risk management activities. The savings that are expected to result are expected to be around \$1.5M per year.

Example

A production facility plans to perform a pollution prevention/ waste minimization opportunity assessment on one segment of the plant's process and to implement waste minimization activities based on the findings of the assessment. Preliminary evaluations have indicated that the resulting waste reduction would substantially reduce disposal costs. It is estimated that costs could be reduced by around \$3M per year.

1.6 Environmental Protection

Environmental impacts are defined as damage to a significant public resource such as: air, water, land or wildlife. These impacts would primarily result from accidents involving the release or spill of radioactive or hazardous materials to the environment.

Impact 16 Catastrophic damage to the environment (widespread and long-term or irreversible effects)

This impact includes the most severe environmental effects, those with both of the following characteristics.

1. The effects are spread or may be spread over a wide area and are not easily containable in a limited area.
- and*
2. The effects are either irreversible or may only be reversed over a period of several years.

Example

A process at a facility involves the use of industrial solvents. The facility

has proposed a project for better monitoring of the releases from the process. Under current conditions, solvents may be released, travel off-site, and contaminate ground water that serves as the drinking water supply for a nearby community. The water supply would be unusable and an alternative supply would be needed. Cleanup of the ground water is thought to require 30 years.

Impact 17 Significant damage to the environment (widespread and short-term effects, or localized and long-term or irreversible effects)

This impact includes serious environmental effects that are less severe than those considered under Impact 16 above. These impacts must have one of the following characteristics:

1. The effects are spread or may be spread over a wide area but may be reversed in no more than a year's time.

or

2. The effects are confined to a limited area but are either irreversible or require several years to reverse.

Impact 18 Minor to moderate damage to the environment (localized and short-term effects)

This impact includes less severe effects on the environment than those covered in Impacts 16 and 17. These effects include both of the following characteristics:

1. The effects are confined to a limited area.

and

2. The effects may be reversed within a year's time.

Example

A facility proposes a project to construct double containment of feed lines

into a diesel fuel tank to help prevent leaks. Currently, the tank is vulnerable to leaks, which could spill fuel and contaminate the soil in the area surrounding the tank. Because of the volume and location of the tank, however, the contamination will not spread off-site and will not contaminate any water sources. Clean-up should require only a few weeks.

Section 2 RPM Matrix Likelihood

The RPM matrix columns (see Table 1) constitute the levels of likelihood used in assessing the risk reduction benefit of activities. The matrix uses four levels of likelihood, as given in Table 2. Each likelihood level has an associated numerical value, which is multiplied by the impact weights to derive the risk value for each matrix cell in the matrix column corresponding to the likelihood level.

TABLE 2
RPM MATRIX LIKELIHOOD LEVELS

	A	B	C	D
Likelihood	Very High	High	Medium	Low
Numerical Value	1.0	0.1	0.01	0.0001
Expectation	≥ 1 in 1 Year	< 1 in 1 Year, ~ 1 in 10 Years	< 1 in 10 Years, ~ 1 in 100 Years	< 1 in 100 Years, ~ 1 in 10,000 Years

The likelihood levels are defined as:

- A. Very High likelihood indicates an impact already exists with certainty or is expected to occur at least once per year. For example, if a facility is known to be out of compliance with a DOE ES&H Order, then the likelihood of this impact falls into the *very high* category. If a condition at a facility has historically resulted in one or more lost-time worker injuries per year and the condition has not been corrected, then the likelihood of this impact also fits this category.
- B. High likelihood indicates that an impact is expected less frequently than once per year, but more frequently than once every 10 years. Such impacts are expected to occur within the operating history of the facility, but have not occurred regularly every year.
- C. Medium likelihood indicates that an impact is expected less frequently than once every 10 years but more frequently than once every 100 years.

Impacts with this likelihood are not expected frequently within the operating life of a facility, but may occur once in the facility's life.

- D. Low likelihood impacts are unlikely to occur within the operating life of a facility, but are not completely precluded from occurring. For example, impacts in this category may occur once in the operating life of one facility out of a population of 100 similar facilities. Impacts with this likelihood are expected to occur less frequently than once per 100 years, but more frequently than once per 10,000 years.

The RPM columns represent four specific likelihood values that may be used in assessment of risks for activity scoring. In addition, the ES&H Management Plan Information System allows other likelihood values to be entered directly. Such values may be entered if information exists that supports other specific likelihood values for impacts in the risk scoring of an activity.

Example

A portion of a non-reactor nuclear facility Safety Analysis Report analyzes a scenario in which an extreme over-exposure of workers could occur. The likelihood of this scenario is estimated to be 10^{-3} per year. A fix has been defined to remove the possibility of this scenario. In deriving the RPM score for an activity representing implementation of the fix, impact 4 (extreme over-exposure of workers) applies. Because the estimated likelihood of the scenario falls between the representative likelihoods for RPM columns C and D (10^{-2} and 10^{-4}), this likelihood value may be entered directly in the Information System; the risk score for the impact-likelihood combination representing this scenario is 2 ($=10^{-3}$ times 2000). Note that a likelihood value other than one of the RPM matrix column likelihoods was used in this case because specific information was available (i.e., part of a facility SAR) to support a different value.

Section 3 Allowance for More Precise Values for Impacts and Likelihoods

The RPM matrix includes discrete values for severity of impact (the rows of the matrix) and the likelihood of experiencing these impacts (the columns of the matrix). These discrete values should be adequate to support prioritization of activities in most instances. However, if the facility has more precise risk assessment information available, the RPM can be modified to accommodate such information. More precise information can be incorporated in two ways:

- Instead of using the discrete likelihood levels discussed in Section 2, the RPM can accept any likelihood between 0.0001 and 1.0;
- A consequence multiplier can be applied to each impact to interpolate between or extrapolate beyond the discrete impacts levels of the RPM.

For example, the consequence multiplier can be applied to the Public Safety and Health or Site Personnel Safety and Health categories account for the size of the population impacted. The RPM weights in each RPM matrix cell in these categories have been assigned based on an assumption that each impact affects 10 persons. If a significantly higher or lower number of persons are affected by an impact, however, then different weights are appropriate. Specifically, the weight should vary proportionally to the number of affected persons.

The RPM cell weights may be used exactly as given in the matrix, without adjustment, if the activity scorers determine that the implicit assumption of ten persons being affected by the impact is sufficient to score an activity appropriately. If the number of persons expected to be affected by an impact diverges significantly (either higher or lower) from this assumption, so that the risk benefits of the activity are not represented appropriately by the RPM cell weights, the process allows for an additional factor to be specified to multiply by the RPM cell weights.

The appropriate adjustment factor equals the number of persons expected to be affected divided by ten. For example, if 100 persons are expected to be affected by an impact, then the multiplier equals 10 (= 100 persons affected divided by 10 persons implicit in RPM weights). If no more than one person is expected to be affected, then the multiplier equals 0.1 (= 1 person affected divided by 10 persons implicit in RPM weights).

The consequence multiplier can be applied for those impact categories with continuous impact scales (e.g. number of injuries, risk management investment dollars) and where additional quantitative risk assessment information is available to establish a basis for the more precise values. The multiplier should not be used to interpolate between

levels of compliance.

The ES&H Budget Plan Information System and ADS form includes fields in which the consequence multiplier may be entered when an activity is scored. These fields have default values of one, indicating no adjustment to the RPM weights.

Example

A national laboratory plans a program to reduce lost time injuries to lab workers. Currently, such injuries occur at a rate of 100 per year. The proposed program intends to reduce this rate significantly. An ADS is prepared to represent this program. In scoring this activity, Impact 6 (lost-time worker injuries) applies with a RPM likelihood category of A (greater than once per year). In addition, the number of persons affected by the impact significantly exceeds the 10 per year assumption implicit in the RPM weight for Impact 6. The appropriate multiplier for 100 injury victims per year is 10 ($=100/10$). This results in a scaled weight for the Site Personnel impact equal to 1000 (Impact 6, Likelihood A RPM weight equals 100, multiplied by a scaling factor of 10).

Example

A site proposes to upgrade safety analysis reports for a nuclear facility at the site. It is anticipated that the additional analysis of facility hazards will result in discovery of previously un-analyzed scenarios that could lead to release of radioactivity beyond the site boundary and exposure of the surrounding general population to potentially lethal doses. The likelihood of any of these scenarios occurring is very low (a total of around 0.0001 per year), but the site is adjacent to a town with a population of 10,000. If the postulated scenarios and releases occur, it is expected that 10% of this population could receive lethal doses. Thus in RPM scoring of these risks, Impact 1 (fatality to members of the public) and likelihood level D (1 in 10,000 years) apply. To account for the high number of potential victims, a scaling factor of 100 should be specified ($=10\%$ of 10,000 total population divided by 10). The adjusted RPM impact weight equals 30 (RPM Impact 1, Likelihood D, multiplier of 100).